MANAGERIAL COMPETENCIES IN SUPPLY CHAINS FOR INDUSTRY 5.0

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Purpose: The purpose of this article is to identify the key managerial competencies necessary for supply chain management in the context of Industry 5.0. The study attempts to identify which skills are particularly important for leaders in the medical device manufacturing sector under conditions of digital and organizational transformation.

Research methodology: the study used a diagnostic survey method, based on a CAWI questionnaire, addressed to a purposively selected sample of 34 senior managers - including logistics and purchasing directors and business owners from Polish and foreign markets. A three-level Likert scale was used to assess competencies.

Results: Problem solving was considered the most important managerial competency - indicated in unison by the majority of respondents from both groups. Creativity, balanced thinking, clear communication and creating an open work environment were also highly rated. Slight differences were also revealed between domestic and foreign respondents in such competencies as decision-making and delegating tasks in a digital environment.

Research limitations/implications: A limitation of the study is the small and non-random survey sample resulting from the purposive selection of respondents. The results can form the basis for further quantitative research and in-depth qualitative analysis, as well as cross-industry and cross-cultural comparisons.

Practical implications: The findings can serve as a guideline for HR departments and talent development managers when planning strategies for training, reskilling and upskilling executives in digital supply chains. The identified competencies should be integrated into HR management policies.

Social implications: the study underscores the importance of social and emotional competence in the era of digitization, supporting the human-centric approach of Industry 5.0. This can contribute to building a more empathetic and sustainable work environment.

Originality/value: The article brings a new perspective to the literature on competency management in the context of Industry 5.0, focusing on the practical insights of leaders in the medical device manufacturing sector. It provides value to researchers, management practitioners and HR policy designers.

Keywords: managerial competence, supply chain, Industry 5.0, healthcare industry, digital transformation.

Article category: research article.

1. Introduction

There are many definitions of managerial competence in the literature. There is a lot of controversy about the understanding of the concepts associated with the buzzwords manager, leader, leader. Some authors put an equal sign between these categories, others try to distinguish a different definition for each buzzword. This is certainly due to the specifics and nature of the work environment in which managers, leaders or leaders move. According to Penc, a manager is a person who manages the work of others within the established structure of an organization (Penc, 1997, p. 188). Griffin, on the other hand, points out that a manager is a person responsible for implementing the functions of management: planning, organizing, leading and controlling (Griffin, 2005, p. 7). Crow AND Prokopovich point to Mintzberg, who proposes blurring the boundaries between the roles of leader and manager. He believes that instead of separating, for example, management from leadership, we should consider managers as leaders and leadership as management done well (Wrona, 2016; Prokopowicz,2022). Arguably, managerial skills are conducive to the role of both commander and leader (Balcerzyk, Žukovskis). In the studies of the last few years (Murphy, Poist, 2006; Shou, Wang, 2017; Pereira, Sheta, 2021) in the field of management, one could find a relevant set of managerial competencies in relation to Industry 4.0. Only recently with the EU Industry 5.0 report has the topic of managerial competencies started to be explored in terms of humanocentricity, resilience and organizational sustainability. The topics addressed, and in particular the research conducted, fill a research gap concerning the role of managerial competencies in Industry 5.0. As indicated above, no research has been conducted to date on the importance of managerial competencies in the context of Industry 5.0. It is therefore reasonable to ask what significance the identified managerial and emotional competencies have in the era of digitalization, supporting the human-centered approach of Industry 5.0? The structure of the article corresponds to the need to justify the research gap. Managerial competencies in supply chains were characterized, along with a relevant review of the literature on the Industry 4.0 era, which initiated the emergence of requirements for managers and their skills. Then, based on the identified research gap, a literature review was conducted and a proprietary set of competencies for Industry 5.0 was proposed. The next stage was to present the characteristics of the research and the industry in which it was conducted, and to determine the relevance of the selected medical equipment industry. The article concludes with a discussion and conclusions and recommendations that clearly indicate the importance of managerial competencies in Industry 5.0.

2. Characteristics of managerial competencies in supply chains – a review of the literature

In the research proposals for managerial competencies or the development of existing managerial competencies themselves, a stronger integration of managers with corporate orientations is apparent, treating work as a project and the organization as one project and as a set of projects. This is to deepen the relationship with the environment, through a greater level of technological integration, flows of standardized and normalized data in supply chains and, consequently, in entire value chains (Ribeiro et al., 2021; Prokopowicz, 2022).

The Digital Fastforward (2020) report points out that in order to successfully navigate the future work environment, leaders must realize that the assumptions they have made may be wrong. This means prioritizing new ideas and rapid change based on what they have learned so far. Managers, given the increasingly turbulent economic environment, must remain open to feedback and change. This approach is at the heart of the re-imagining of new work opportunities and how to operate in an uncertain future. Many works also note the context of the virtualization of companies' operations and the often remote work of managers and professionals (Pilipchuk, 2020). However, it should be noted here that this approach is characteristic of certain industries. There remains a whole host of industries where humans are indispensable despite the use of smart solutions or the creation of factories of the future.

Reviewing the literature, the authors of the study decided to identify basic definitions of managerial competencies in supply chains in the context of Industry 4.0 and their further evaluation in relation to Industry 5.0.

2.1. Managerial competencies in supply chains in the context of Industry 4.0.

In the case of identified managerial competencies suitable for the development of Industry 4.0, several examples can be pointed out. According to the concept of Industry 4.0, all data relevant to enterprises is to be collected and analyzed, which is supposed to distinguish them from most modern enterprises and supply chains, which, however, due to capital and technological constraints cannot afford to do so (Shaba et al., 2019). According to Pereira and Sheta (2021), the set of managerial competencies that would address the challenges of developing enterprises and supply chains in the Industry 4.0 environment are: agility, entrepreneurial intelligence, business savvy, design thinking, breakthrough leadership, collaborative and problem-solving and decision-making mindset, and research orientation.

Murphy and Poist (Murphy, Poist, 2006), based on an analysis of data obtained from 32 U.S. head hunters of recruitment firms that specialize in recruiting managers in logistics, transportation, supply chain management and related fields, distinguish three types of skills for logistics and supply chain managers: business, logistics and management.

1. Business includes knowledge of various areas of business such as economics, psychology sociology.

2. Logistics skills related aspects such as transportation, warehousing, inventory management and supply chain operations.

3. Management skills relating to planning, organizing and coordinating logistics activities along with personal attributes such as leadership, communication and problem-solving skills.

Gammelgaard and Larson distinguished among managerial competencies: ambition, critical reasoning, decision making, ethics, listening, motivating, organizing, presentation skills, prioritizing, problem solving, self-learning, self-discipline, speaking/oral communication, time management, training (training), written/written communication. Managerial competencies, according to these authors, can also include basic supply chain management (SCM) skills, i.e. the ability to see the big picture, which refers to the ability to understand and analyze the overall context, goals and objectives of a situation or organization, change management, trust and credibility, awareness of interdependencies and interconnectedness (of functions and departments of an organization), leadership, knowledge of the industry (best practices, regulations, major players), negotiation skills, language skills, organizational culture, project management, SCM awareness, teamwork, knowledge of the latest technologies and techniques.

In addition, Shou and Wang (2017) through a survey of job advertisements in various countries (900 samples in total) introduced a very broad catalog of competencies and introduced the category of general skills, functional skills, SCM qualifications and leadership, SCM expertise, and industry and senior management skills (Shou, Wang, 2017). Among managerial competencies, they listed soft skills such as communication and coordination, supply chain management qualification and leadership i.e. knowledge of SCM principles, ability to lead SCM initiatives.

Similar conclusions were reached by shadowing studies. Researchers collected and documented observation material. For 10 selected days over six weeks, three researchers observed the work of two managers each (for a total of six managers). The material provided detailed insight into the managers' activities, interactions and decision-making processes in their daily work. Logistics and supply chain managers use a combination of business, general and behavioral managerial competencies in practice, making up a certain competency profile (Derwik et al., 2016). The authors note that it goes beyond supply chain management expertise. The profile consists of:

1. general competence, as opposed to specialized competence;

2. multitasking competence (working with multiple computer screens, cell phones and phone interruptions and employees seeking advice;

3. a bundle of different types of competencies beyond those mentioned in 1 and 2 using synergies. Managers actually use competencies in combination with each other, leading to synergistic effects. For example, in problem solving, managers also combine information gathering skills and company experience to find better solutions faster;

4. company experience - identified as a separate competency, but rarely mentioned in the literature. Experience and knowledge of the company's policies, history of customers, suppliers helps in setting tasks in personnel management.

Based on a survey (Prajogo, Sohal, 2013) of 145 Australian supply chain managers, competencies and skills were identified that need to be developed among supply chain professionals to significantly improve supply chain efficiency and integration. Communication and teamwork skills, as well as knowledge of a wide range of technologies, were identified as the most important.

A review of research on the competencies of logistics and supply chain managers suggests that competencies unique to supply chain managers include areas such as business, logistics, interpersonal management, technological competence, functional competence, SCM knowledge, and industry skills (Derwik, Hellström, Karlsson, 2016).

Supply chain managers are critical to the global economy. They represent a unique discipline responsible for supporting the global delivery network of products and services throughout the supply chain, from raw materials to end customers. Specifically, supply chain managers engage in the design, planning, execution, control and supervision of supply chain activities to create net value, build competitive infrastructure, leverage global logistics, synchronize and manage the supply chain (Apics, 2014). The Apics Association has created a diagram of managerial competencies related to professional affiliation (training, certifications, MBA), profession (skills required for the position such as supply chain manager) and the foundation of managerial competencies (skills and abilities that allow individuals to function in an organizational environment such as personality traits, acquired knowledge).

With the development of the concept of Industry 4.0 and its evolution to the concept of 5.0, attention began to turn to the context of corporate social responsibility and sustainability. According to Rego, Pina and Polonia (2017), leadership competencies should focus on visionary, interdisciplinary and self-leadership (Zaleśna, 2019).

Meier (202) points out that the development of managerial competencies in supply chains is carried out in two dimensions: *fusion skills* and competence enhancement through a competence argumentation strategy. Both are related not only to managerial competencies, but also to the development of machine competencies, which is part of the Industry 4.0 trend (Prokopowicz, 2022).

The approach mentioned earlier in the introduction (Ribeiro, Amaral, Barros, 2021; Prokopowicz, 2022; Rego, Pina, Polonia; Grzybowska, Lupicka, 2017) to managerial competence can also be applied to supply chains.

Below is a table with selected views on managerial competencies in supply chains in the context of Industry 4.0.

Table 1.
Views on managerial competencies in supply chains in the context of Industry 4.0

Author(s)	Views regarding managerial competencies in supply chains in the context of Industry 4.0.
Murphy, Poist (2006)	Three types of skills for logistics and supply chain managers: business including knowledge of various business areas, logistics related aspects such as transportation, warehousing, inventory management and supply chain operations and management skills relating to planning, organizing and coordinating logistics activities along with personal attributes such as leadership, communication and problem-solving skills.
Gammelgaard, Larson (2001)	Core managerial competencies include ambition, critical reasoning, decision making, ethics, listening, motivating, organizing, presentation skills, prioritizing, problem solving, self-learning, self-discipline, speaking/oral communication, time management, training (training), written/written communication.
Shou, Wang (2017)	Among the managerial competencies listed soft skills such as communication and coordination, qualifications and leadership in supply chain management i.e. knowledge of SCM principles, ability to lead SCM initiatives.
Derwik et al. (2016).	Logistics and supply chain managers put into practice a combination of business, general and behavioral managerial competencies, making up managerial competency profile.
Prajogo, Sohal (2013)	The most important managerial competencies were considered to be communication and teamwork skills and knowledge of a wide range of technologies.
Shet, Pereire (2021)	The proposed set of managerial competencies in Smart organizations are: agility, entrepreneurial intelligence, business proficiency, design thinking, breakthrough leadership, collaborative mindset, strong attitude on problem solving and decision making, research orientation.
Apics (2014)	A diagram of managerial competencies related to the affiliation of the profession (training, certificates, MBA), the profession performed (skills required for the position, e.g., supply chain manager) and the foundation of managerial competencies (skills and abilities that allow individuals to function in the organizational environment such as personality traits, acquired knowledge).
Ribeiro, Amaral, Barros (2021)	In the research proposals for managerial competencies or the development of existing managerial competencies themselves, a stronger integration of managers with enterprise orientations, treating work as a project and the organization as one project and as a set of projects, is evident. This is to deepen relationships with the environment, through a greater level of technological integration, flows of standardized and normalized data in supply chains, and consequently in entire value chains.
Digital Fastforward (2020)	to successfully navigate the future work environment, leaders must realize that the assumptions they have made may be wrong. This means prioritizing new ideas and rapid change based on what they have learned so far. Managers, given the increasingly turbulent economic environment, must remain open to feedback and change. This approach is at the heart of the re-imagining of new work opportunities and how to operate in an uncertain future.
Rego, Pina e Cuncha (2017)	leadership competencies should focus on visionary, interdisciplinary and self-leadership.
Meier (2021)	The development of managerial competence is carried out in two dimensions: *fusion skills* and competence enhancement through competence argumentation strategy. Both are related not only to managerial competencies, but also to the development of machine competencies, which is part of the Industry 4.0 trend.
Grzybowska, Lupicka (2020)	The new managerial competencies are an extension of all the already known competencies: creativity, decision-making, problem-solving, conflict resolution, analytical skills, research skills, efficiency orientation.

Source: own elaboration.

2.2. Managerial competencies in supply chains in the context of Industry 5.0.

Analyzing the arguments of academics and practitioners to date, a certain paucity of demands for managerial competence in the areas of humanocentricity, sustainability or the resilience of companies and supply chains to the surrounding economic environment becomes apparent. A shift away from the main demands of Industry 4.0 towards digitalization is clearly marked. Therefore, after analyzing the available articles, reports and compact items, a new, more detailed set of managerial competencies is drawn to meet the challenges of Industry 5.0.

Today's managers in enterprises and supply chains to meet the demands of maintaining organizational resilience or sustainability activities must be flexible in their competencies. Depending on the given situation, managers apply an appropriate set of managerial competencies. The following table shows the most desirable competencies in the Industry 5.0 era as defined by the literature and previous arguments about the managerial competencies of the 4.0 era Based on the literature review (European Commission et al., 2021; McLaren, 2021; Audrey, Paksi, 2021; Dwivedi et al., 2023; Song et al., 2021; Knut, Balaji, 2013; Gartner, 2023; APICS, 2014; Hoffman et al., 2005; Relich, 2015; Joerres, McAuliffe, 2016; Winter, Heindl, 2016; Davis et al., 2011; Bauer et al., 2015; Störmer et al., 2014; Pompa, 2015) listed the most commonly identified managerial competencies relating to supply chains in the 5.0 economy era. listed the most commonly identified managerial competencies relating to supply chains in the 5.0 economy era. The shape of these competencies has evolved over time. Most of the works focused on supply chain competencies, without highlighting the role of sustainability economics. Much of the work focused on competencies in relation to Industry 4.0 (Hoffman et al., 2005; Joerres, McAuliffe, 2016; Störmer et al., 2014; Morgan, 2014). After a deeper analysis of the literature, 16 managerial competencies have been identified (Tajbakhsh, Hassini, 2015; Adams et al., 2021; Da Silva et al., 2019; de Janasz et al., 2014; Park, Faerman, 2019; Baron, Markman, 2000; Audrey, Paksi, 2021; Song et al., 2021; Morgan, 2014) that are required by companies establishing supply chains in the 5.0 economy. They are listed below in the table in sequence with a description. Their relevance to aspects of Economy 5.0 has been taken into account. Of course, this set of competencies can also be used for traditional supply chains, but the authors believe that these 16 managerial competencies are particularly predestined for the requirements of Industry 5.0 supply chains.

Table 2.
Managerial competencies in supply chains in the context of Industry 5.0.

Lp.	Managerial competence	Description
1	Ability to organize time	In the age of the digital economy, time planning is becoming one of the factors for survival and success in a turbulent economic environment. Time management is all about the ability to plan, organize and effectively use available time to achieve goals and complete the tasks ahead. What is important is how we schedule the time both needed to meet commitments to work and the personal time needed for our own psychological well-being (Seiwert, 1998).
2	Balanced thinking	The ability to perceive deeper meanings and hidden senses taking place in the economy. The human mind is guided by established patterns, routine tasks, which does not allow for a more insightful discernment of reality. Sustainable thinking requires managers to go beyond the beaten patterns and take control of their own limitations
3	Innovative and adaptive thinking	Innovative thinking that streamlines adaptation to constantly occurring changes. Successful innovations improve products or processes and ultimately lead the company to a leadership position in the market. The main determinant of innovation, is the strength of competition between companies in the industry (Golej, http://www.instytut.info/IIIkonf/referaty/1c/golej.pdf, 17.03. 2012).
4	Collaboration in a virtual environment	The ability to work productively and with commitment as a member of a virtual team. Cooperation in a virtual environment is encroaching more and more on the activities of companies in many different sectors of the economy. Such an approach is being forced by the economic situation related, for example, to the search for unique resources, often available on the other side of the world. Virtual meetings make it possible to conclude agreements at a distance, but for this to happen a certain set of skills characterizing a competent manager is needed. An effective manager in conducting virtual meetings should skillfully develop a common vision and goals for a cooperating team on two different ends of the world.
5	Creativity	Creativity is characterized by the ability to see the world in new ways, find hidden patterns, make connections between seemingly unrelated phenomena and generate solutions. A creative manager uses both his knowledge, creative thinking skills and motivation. Knowledge refers both to knowledge of procedures, technical knowledge but also to intellectual qualifications.
6	Troubleshooting	Problem solving requires both analytical and creative skills. Analytical or logical thinking includes skills such as comparing, evaluating and choosing. When solving problems, patience and flexibility are key. In particular, managers managing complex supply chains need to demonstrate a logical approach to solving problems. This cannot lack such elements as understanding the problem, analyzing the available information to analyze the situation, creating an action plan and implementing it, monitoring progress in solving the problem and evaluating the results.
7	Decision-making	Decision-making is the process of making choices by identifying decisions, gathering information and evaluating alternatives. The decision-making process requires clear and precise communication in which all risks and prospects are taken into account. Every problem is different, but the techniques and methods used to solve them should be methodical and focus on several steps, avoiding constant crisis and hasty decisions.
8	Research skills	Research skills can come from the need to use reliable sources for continuous learning in a changing environment. Researcher's skills are primarily the ability to think critically by properly evaluating information their verification and drawing relevant conclusions. In an age of information overload, it is also important to extract reliable data from available documents, interviews or lectures and discussions.

Cont. table 2.

9	Analytical skills	Analytical skills are the ability to visualize, gather information, express, analyze, solve complex problems and make decisions. In a business context, they are invaluable because they provide a deeper understanding of data, market trends, customer needs and many other aspects that are critical to a company's success. These skills include logical thinking, the ability to draw conclusions, evaluate situations and predict potential outcomes (https://bigglo.pl/slownik/czym-sa-umiejetnosci-analityczne/, 23.05.2024).
10	Creating an open environment	Encouraging employees to work together to solve problems and improve business practices. Creating an open environment requires managers to use a variety of leadership styles including democratic and authoritarian. It is particularly helpful to choose those characteristics of a particular style that will offer mutual trust, making employees feel that they are taken seriously by their superiors. An open environment is also fostered by open communication characterized by the ability to freely express one's own opinions and ideas.
11	Communicating clearly to avoid misunderstandings	Clear, simple and understandable language of speech allows for faster transmission of commands and enforcement. Managers should use clear, simple and understandable language of speech which allows for faster transmission of orders and enforcement. Avoiding complicated words and whole phrases will make it easier to communicate with employees. Not always particularly developed erudition is a desirable trait for a managerial position. It is definitely better to express yourself in a way that the recipient can understand. You should also avoid ambiguity and make sure that the sentences you formulate make sense and will not be understood otherwise.
12	Negotiation skills	The ability to use different methods of negotiation effectively leads to compromise or negotiating advantage. An important role in negotiating is played by the attitude we adopt. A positive attitude toward negotiation as a tool for human resource management can be expressed, among other things, by attempting to conduct negotiations, the frequency with which they are conducted, commitment to implementation and adherence to the agreements made. In the case of a negative attitude, there is the use of other forms of management, such as more directive, authoritarian ones. If negotiations are perceived as a fair way of enforcing and protecting employee interests, the supervisor treats them as an effective management tool, enjoys this form of contact with co-workers, this will promote the formation of mature negotiating competencies of managers (Kowalczyk, 2013).
13	Ability to delegate authority to employees at lower levels	The enormity of information forces the delegation of some tasks and decision-making to lower levels of employees. The ability to delegate authority to employees at lower levels is inextricably linked to a given manager's personality traits, self-esteem and skills. This is a trait that people in managerial positions should possess in these digitalized times. It is incumbent on those who delegate work to employees to keep abreast of advances in the economic sphere and the digitization of the environment, and this means that managers or executives are often unable to reconcile professional management with keeping up with the dynamic development of new technologies. Therefore, there is an objective need , that the tracking of progress, the initiation of changes, their adaptation to the conditions of a particular organization and implementation are handled, in addition to leaders, primarily by lower-level specialists and employees delegated to such tasks (Oleksyn).
14	Posting employees to jobs according to their skills suited to working in the digital economy	Managers and supervisors are required to provide "comfort" to employees, showing them the way to achieve the right digital skills. Managers and supervisors are tasked with posting employees according to their skills suited to working in the digital economy.

Cont. table 2.

| 15 | Performance orientation | An "efficiency" approach is one that emphasizes the efficient use of resources as the main determinant of decisions and actions. Every manager, as mentioned earlier, should skillfully delegate tasks to employees, depending on their professional competence. What matters in this case is performance orientation, that is, planning tasks in such a way as to make the most effective use of employees' skills. This is not an easy task, especially when dealing with newly hired employees. Individuals hired for a particular position may have specific skills suited to the job, but sometimes it may turn out that a particular employee has other valuable competencies to perform completely different tasks. Therefore, a manager or team leader is also expected to take a close look at subordinates and delegate work according to their skills. |
| 16 | Entrepreneurship | Entrepreneurial thinking skills refer to the ability to identify market opportunities and discover the most appropriate ways and times to exploit them. Rather, it is a state of mind that opens one's eyes to new opportunities. Entrepreneurship is inextricably linked to the learning organization. Entrepreneurial thinking skills refer to the ability to identify market opportunities and discover the most appropriate ways and times to exploit them. It is a kind of state of mind that allows to look more broadly at new opportunities. To develop a mind for new market opportunities one must constantly learn about the market, customers and lurking competitors. |

Source: own elaboration.

3. Research methodology

The authors of the article decided to conduct a survey of a purposively selected research group. The group consisted of senior managers managing logistics and supply chains in manufacturing companies (directors of logistics and purchasing departments) and owners or CEOs of manufacturing companies in the medical industry. This made it possible to reach respondents who, by virtue of their positions, should have knowledge of key managerial competencies. This selection of respondents involved conducting the survey on a smaller, non-random sample, but allowed for objective results due to their extensive knowledge and professional experience, as well as their leadership of teams on an international scale. A total of 34 respondents took part in the survey, 20 from the Polish market and 13 from the global market. Only senior executives were selected for the study, a larger research sample was beyond the research capabilities of the authors of the article. The questionnaire was distributed after direct contact by email or telephone to explain the purpose of the survey, how it would be conducted, and the significance of the research area. At the same time, substantive and technical instructions were provided. The questions in the survey were developed based on literature reviews and previous pilot studies conducted in 2017 and 2018 (Łupicka, Grzybowska, 2017, 2018). This allowed us to review the existing questionnaires and modify them with additional important questions concerning managerial competencies in the Industry 5.0 environment. The companies participating in the survey were located in Europe, North America and East Asia and had diverse manufacturing operations in the medical device industrial sector.

The survey was conducted in June 2023. The survey questionnaire was prepared in electronic form. It was distributed to the companies via Internet mail. Respondents were assured of anonymity. The survey used the CAWI (Computer-Assisted Web Interview) method, in which the participant is asked to complete the questionnaire electronically. The survey used a three-point Likert scale, where 1 meant unimportance of a given competence, 2 hard to say and 3 importance of a given competence. Three-point scales communicate two pieces of information (neutrality and direction). When asking respondents to take the survey, care was taken to ensure credibility and trust in the researcher and the survey being conducted. The survey did not include "sensitive" questions and was conducted in accordance with the Code of Ethics for Research Workers (Commission on Ethics in Science (2020) and general rules regarding RODO.

4. Industry characteristics

According to Fortune Business Insights, the global medical device market was worth $425 billion in 2018. It too is projected by the institution to expand by another 190 billion by 2025, growing at just over 5 percent year-on-year. This growth is being driven by both demographic and lifestyle changes and the resulting health consequences, as well as aging hospital infrastructure (PARP - report2021)

In a short time, one-fifth of the total population in the European Union will be senior citizens, in Japan, for example, as many as one-third. An aging population and a growing global population will cause it to grow by another billion over the next decade, to 8.6 billion people, reaching nearly 10 billion by 2050 - not the only challenges health systems will have to face.

Unhygienic lifestyles, lack of physical activity and unhealthy, junk food promote obesity, insulin resistance, diabetes and heart disease and cancer. In China and India alone, the number of diabetics is estimated at 200 million. Worldwide, there are already more than 400 million, and that number is expected to increase by half in the next dozen years. According to the WHO (World Health Organization), there were 466 million deaf and hard-of-hearing people in 2018, representing an ever-growing market for hearing aids and assistive listening devices. Health problems are not the only scourge of modern societies, the other huge problem is aging, often depleted hospital infrastructure. In Europe and the United States, the main challenge in this area is to use modern technology, among other digital technologies, to reduce costs while increasing accessibility and raising the quality of health care. The medical device market includes the sale of equipment and accompanying services such as maintenance, rental and training. The main users are patients and medical personnel in healthcare facilities. The devices are used for diagnosis, therapy, monitoring and prevention. This market is distinguished by high regulatory

requirements, including environmental ones, which entails going through costly and time-consuming certification processes.

5. Test results

Analyzing the survey results, it is clear that the most important managerial competence is problem solving, both for Polish and foreign managers.

Table 3.
Managerial competencies in the light of research

Managerial competencies	Domestic respondents		Foreign respondents	
	Average	*Standard deviation*	*Average*	*Standard deviation*
Ability to organize time	2,60	8,326664	2,85	6,658328
Balanced thinking	2,80	5,507571	2,85	6,658328
Innovative and adaptive thinking	2,45	7,371115	2,62	4,932883
Collaboration in a virtual environment	2,55	7,371115	2,38	4,50925
Creativity	3,00	11,54701	2,85	6,658328
Troubleshooting	3,00	11,54701	3,00	7,505553
Decision-making	2,10	5,859465	2,62	4,932883
Research skills	2,70	9,073772	3,00	7,505553
Analytical skills	2,60	7,234178	2,54	7,505553
Creating an open environment	3,00	11,54701	2,85	6,658328
Communicate clearly to avoid misunderstandings	2,80	9,865766	2,85	6,658328
Negotiation skills	2,60	8,326664	2,62	4,932883
Ability to delegate authority to employees at lower levels	2,75	8,962886	2,62	4,163332
Posting employees to jobs according to their skills suited to working in the digital economy	2,25	5,507571	2,69	5,859465
Performance orientation	2,70	9,073772	2,77	5,773503
Entrepreneurship	2,80	9,865766	2,77	5,773503

Source: own compilation based on surveys.

In the case of competencies such as performance orientation, entrepreneurship, negotiation skills, communicating clearly to avoid misunderstandings, creating an open environment and, finally, balanced thinking, respondents mostly favored the significant importance of these skills. Differences between domestic and foreign respondents became apparent in the case of competencies such as delegating employees to jobs according to their skills adapted to work in the digital economy, research and decision-making skills. Other competencies were rated relatively well by more than half of the respondents.
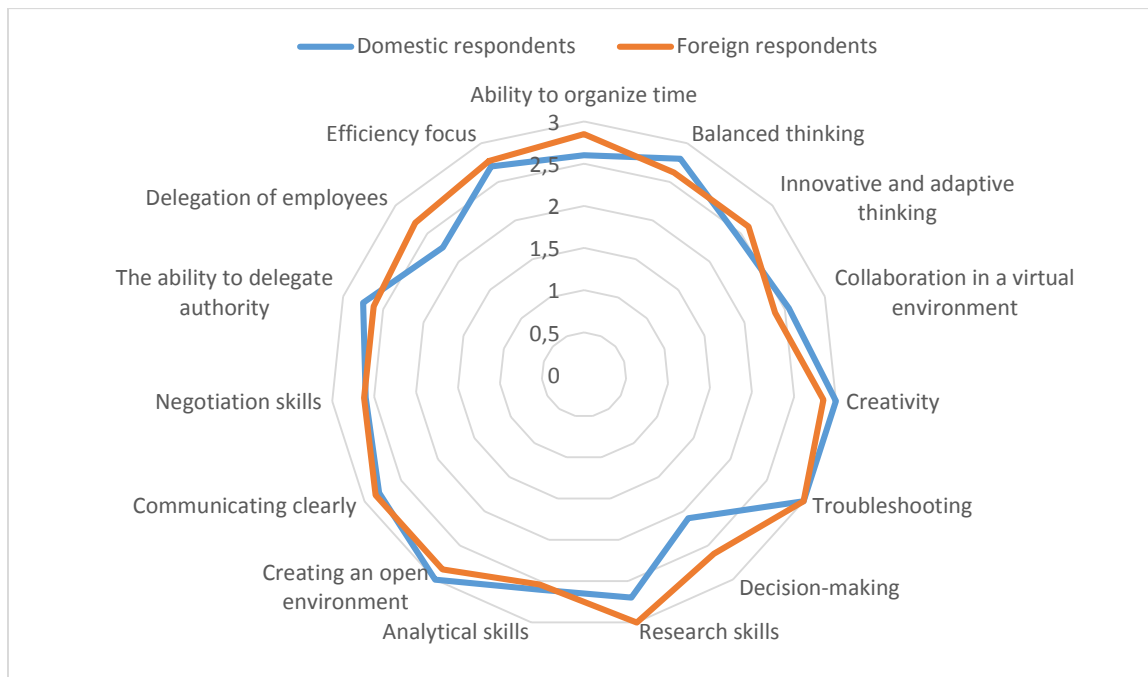
Figure 1. Managerial competencies in the light of surveys.

Source: own elaboration.

Analyzing the results of the standard deviation shows slight differences between the distribution of responses in the Polish and foreign markets. The standard deviation (SD) measures the extent of scattering in a set of values, typically compared to the mean value of the set (Foltynowicz, Łupicka, Jeszka, 2024). Intuitively speaking, the standard deviation tells how widely the values of some quantity are scattered around its mean. The smaller the value of the deviation, the more the observations are clustered around the mean (sustainability, our article). In the case of domestic respondents, the most similar responses were related to three managerial competencies, among others, balanced thinking, decision-making and, finally, posting according to their skills adapted to work in the digital economy. For foreign respondents, it was primarily the ability to delegate authority to employees at lower levels and to collaborate in a virtual environment.

6. Discussion

Technologies such as artificial intelligence, big data, internet of things, blockchain and cyber-physical systems, and topics such as operator 4.0, digital transformation, as well as sustainability and resilience (Madsen et al., 2023) have been identified as the most studied issues related to Industry 5.0. EC documents talking about the transformation of the European economy towards Industry 5.0 emphasize the importance of human capital. Technology is meant to serve people - this human-centric approach is an important difference from the

revolution referred to as Industry 4.0. (European Commission et al., 2021; European Commission. Directorate General for Research and Innovation., 2021) . Industry 5.0 places the welfare of the worker at the center of production processes (Xu et al., 2021).

The most important change in the 5.0 concept from Industry 4.0 is the shift in focus from technology-based advances (IoT, AI, digital twins, robotics, augmented reality) to human-based advances. It is the industry that is to adapt to the needs of the worker, not the human being that is to adapt to the ever-evolving technology (Xu et al., 2021).

This approach has raised the question of whether there will be new challenges in the field of supply chain management and logistics, and what managerial competencies are needed to make the right decisions about the development of organizations and supply chains in the context of the economy's transition towards Industry 5.0.

In the era of Industry 5.0 and widely improved skills related to the economic, social and environmental development of organizations and the emphasis on developing technological and risk management skills, the importance of human collaboration - a key skill in management, including supply chain management - must be restored. Just as important as expertise and process knowledge are specific social, managerial and digital competencies.

Knowledge of currently sought-after competencies, which should be taken into account in the policy of personnel and staff development in various categories gives rise to the demand among employees for training, further education and upgrading of qualifications, the so-called reskilling and upskilling, and Human Resources staffs are faced with this task.

In today's turbulent times, characterized by the constant chase for more and more technological solutions, managerial competencies must be constantly developed.

Leaders and supply chain managers must clearly define each required competency needed to manage teams in digital supply chains. At the same time, they also need to analyze the current owned competencies and skills to identify the gap that needs to be filled to support the digital supply chain vision.

In addition, future tasks and decisions facing managers should be assessed. The most important question should be which activities will remain within the intuition of soft skills of managers, and which should be digitized. Stakeholder relations tasks will certainly remain the responsibility of managers, while, for example, defining supplier selection algorithms will be more automated and supported by technology(Gartner). At the same time, every organization should be oriented towards the development of so-called "open heart competencies", largely concerning emotional intelligence, as no program or application can replace objective assessment of a given situation, which can only be done by a human being. Relating this issue to supply chains, it should be noted that in long-term negotiations, empathy, objectivity counts, and artificial intelligence will not help in this task. The same applies to the evaluation of employees, rigidly written algorithms will indicate positive or negative evaluations and what about the conscientiousness of work even if a given employee is not as efficient as his colleague in the same job? In conclusion, it can be said that in the era of digitization, the idea of Industry

5.0 with its humanocentricity is part of the development of modern supply chains. However, in order to strike a balance between implemented technologies digital technologies and social capital, it is important to acquire managerial competencies to maintain this balance.

7. Applications

Based on the survey, it appears that in the context of continuous and dynamic economic and technological changes, and especially in the context of the transformation towards Industry 5.0, managerial competencies are gaining importance, and these include analytical, interpersonal and strategic skills. Respondents particularly noted and emphasized the relevance in the case of competencies such as problem solving, creativity and sustainable thinking, confirming the growing need for a holistic approach to supply chain management.

Both domestic and foreign respondents noted the need to develop competencies that facilitate functioning in a complex and dynamically changing work environment. Differences between groups of respondents may be due to cultural differences or the level of digital maturity of the organization.

From the perspective of management practice, these results underscore the need to integrate the development of managerial competencies into organizational strategies, especially in highly regulated and technologically advanced sectors such as the medical device industry. At the same time, they point to the importance of synergies between technology and human capital, without which the implementation of Industry 5.0 will not be possible.

It is worth considering additional research in the topics taken up in the article. Interesting conclusions may be provided by cross-industry studies or in-depth qualitative research on competencies of the future. Evaluation of the effectiveness of managerial competence development programs in the context of the transformation towards Industry 5.0 and human-centered economy may also be an interesting direction of analysis.

The results of the study show that there is a need to develop creativity and innovation among management staff, particularly in terms of implementing new technological and organizational solutions. It is equally important to develop sustainable thinking skills through additional training. Preparing managers to identify and reduce the negative impact of supply chain operations on the environment would aim to improve ESG skills and the implementation of the circular economy. The above areas of competence are in line with the objectives of Industry 5.0 and contribute to the creation of future-oriented supply chains.

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